Turbomachinery Control for Efficient, Safe, and Reliable Operations

Today's turbomachinery control technology for turbine governor and compressor anti-surge applications must provide faster system response, higher availability, and full standardization so end users can increase asset reliability, improve energy efficiency, and enhance machine safety.

INTRODUCTION

Around the world, industrial operating companies must find ways to increase plant availability and get the most out of their assets while also dealing with smaller workforces and lower budgets. Plant safety and productivity depend on turbomachinery performance; failures and unplanned outages with this equipment can result in lost production and costly repairs. The utility industry and other industrial fields are now moving away from the monopoly of "proprietary black box" providers in favor of innovative solutions that enable plant operators to understand and maintain a single integrated control solution as opposed to several disparate systems.

Turbomachinery controls are utilized throughout the industrial sector—from oil and gas production platforms to chemical plants and pulp, paper, and steel mills. Precise control is needed to maximize the life of the machine and to address safety and compliance at the plant operations level.

For almost 20 years, Honeywell has leveraged its global industrial automation domain expertise to provide customers with advanced turbomachinery controls based on the open, familiar, and easily maintained Experion® PKS platform.

- Offers a superior alternative to the purpose-built OEM or other turbine and compressor control solutions
- Includes unique integration capabilities for turbomachinery applications requiring very fast response times



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- Utilizes partnership with leading turbomachinery specialists to deliver complete OEM-independent solutions to customers
- Eliminates the risk of obsolescence due to easy migration path to the latest technology

FIGURE 1 shows the architecture of the Experion Turbomachinery Control Solution. The operator consoles, flex station consoles, and redundant Experion servers tie into the redundant fault-tolerant ethernet (FTE). On the bottom left of **FIGURE 1** is the turbine and/or compressor control solution, the C300 controller with I/O. We are also able to place an operator station in the field in one of two ways:

- Experion Thin-Client operating connected to hardware with a console license which then can be placed in the field next to the compressor or turbine. Class 1, Div 2; or
- **Experion Panel PC** operating on hardware placed in a field mounted enclosure for a Class 1, Div 2 environment rating.

We also handle all safety functions, so anything that requires an SIL level is handled by Honeywell's safety controller, the SC300, which includes safety interlocks.

C300 TMC CONTROLLER

The C300 controller is Honeywell's flagship controller for the Experion PKS system. It utilizes the control execution environment (CEE), which is supported on several different Honeywell controller platforms, including the C200 (the predecessor to C300), C300, ACE, and UOC controllers. For customers who want to migrate, the CEE environment enables you to export the CEE from an older C200 into a C300 or UOC. The logic stays the same; the only change required is to reassign the I/O, as it's often physically different on various platforms. This ensures nothing changes with the logic and a quicker migration and checkout to the new controller.

The C300 controller is available in 50 and 20 milliseconds cycle times, each having different firmware. The controller can be redundant or simplex, whichever you prefer, but



the C300-20 (TMC) controller not only supports all the existing series-C IO, but it also supports two new IO modules specifically designed for turbine applications as well as the Universal IO (UIO) module, which is a game changer in the turbomachinery business.

SPM & SVMP MODULES

FIGURE 2 shows the Speed Production Module (SPM) and outlines its capabilities and specs. It is used for three different independent purposes:

- 1. Speed control (turbine governor)
- 2. Initial overspeed protection (NOT API-670 compliant)
- **3.** Surge control (prior to UIO availability and dependent upon R511)

FIGURE 3 shows the Servo Valve Positioning Module (SVMP) and outlines its capabilities and specs. It is used for closed-loop valve position.

UNIVERSAL IO MODULE

The UIO module is shown in **FIGURE 4**. UIO can be used with the C300-20 controller starting at Experion R511 or higher. It is ideally suited for electric motor-driven compressors and can be used with the specialty Turbomachinery IO modules (SPM & SVPM) starting at Experion Release R520. This enables the use of steam turbine-driven compressor controls as well as gas turbine controls. The UIO module has 32 configurable IO channels/points. This module scans the field devices at 10 milliseconds, which is important for turbine governor and antisurge control.

What makes this module a game changer is its universal input and output of 32 channels and its high-operating temperature range. The operating range of the UIO is -40° C to +70° C, which means this IO module can be placed in the field on the turbine deck or compressor skid in an enclosure as remote I/O, as it is Class 1 DIV 2 rated.

For applications that utilize the UIO module in the field, we also have the Universal Process Cabinet (UPC). This cabinet

FIGURE 2: Honeywell Turbomachinery Control: SPM Module

Experion PKS TMC Solution built for Turbomachinery Control



SPEED PROTECTION MODULE (R400 or higher)

Used for three independent purposes –

Speed Control, Initial Overspeed Protection, & Surge Control

- Redundant IOTA
- Priority IO Module scan
- Fast Performance Input / Output Scan Rate 2.5 ms, 5 ms, 10 ms
- 25 I/O channels
 - (8) AI & (1) AO 10 ms scan rate (8) DI & (4) DO 5 ms scan rate
 - (4) Magnetic Speed Probe Inputs 2.5 ms scan rate
- Initial Overspeed Protection with 2003 voting Logic at 10 ms at I/O module level
- Electronic short Circuit Protection

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EXECUTIVE SUMMARY

is a standard field-mounted enclosure, Class 1 DIV 2 rated. It's fully self-contained, meaning the UIO modules (up to 96 channels), marshaling, power supplies, and fiber optic transceivers are all contained in this enclosure. There are several different marshaling options that can be used to accommodate site requirements, including the Universal Marshall Solution (UMS). The UMS allows low levels (thermocouples or RTDs) to be brought in and converted to

FIGURE 3: Honeywell Turbomachinery Control: SVPM Module

Experion PKS TMC Solution built for Turbomachinery Control



SERVO VALVE PROSITIONING MODULE (R400 or higher)

- Used for Closed Loop Valve Position
- Position PID Loop at module
- Redundant IOTA
- Priority IO Module scan
 - Fast Performance Input / Output Scan Rate 5 ms
 - (8) I/O channels
 - (2) AI 5 ms scan rate
 - (2) AO Servo Valve Output 5 ms scan rate
 - (2) DI 5 ms scan rate
 - (2) LVDT / RVDT Inputs 2.5 ms scan rate
- Electronic short Circuit Protection

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FIGURE 4: Honeywell Turbomachinery Control: Universal IO Module

Experion PKS TMC Solution built for Turbomachinery Control



C300-20 and Experion R511 or higher Required

- Reduced IOTA size 9" NR and 12" Redundant
- Single HART Modem per channel
- Pulse Input Any 4 channels
- Input Scan Rate 10 ms
- SOE with 1 ms resolution
- 32 Configurable channels for AI/AO/DI/DO
- Priority IO Module scan
- Electronic short Circuit Protection
- High Operating Temperature -40° C to 70° C

a stand 4-20 madc signal. The same is true for high-output current relays or 120 VAC VDC inputs. The UPC, along with the UIO and USM, has an extended temperature range (-40° C to +70° C), so it can go directly on the compressor skid or turbine deck itself.

SAFETY MANAGER SC300

The Safety Manager SC300 (**FIGURE 5**) manages all safety interlocks for your turbine or compressor. Its features and capabilities are outlined in **FIGURE 5**. And, like the UIO module, the safety manager SC300 has a Universal Safety Cabinet (UPC) that is fully self-contained, rated for a hazardous area Class 1, Div 2, has redundant SC300 processors, multiple IO options, redundant power supplies, and supports the extended temperature range.

CONCLUSION

Whether you're in the coal or thermal power plant, refinery, chemical, pulp and paper mill, or offshore industry, with Honeywell's approach to turbomachinery controls, power and industrial organizations can realize valuable benefits from a fully integrated turbine/generator control, turbine/compressor control, or boiler turbine control solution that makes their operations more efficient, reliable, and cost-effective.

Our solution enables better coordination among the various plant subsystems, especially if you have a Honeywell Experion. We provide a common operator interface for the entire plant and improve ROI from existing Experion PKS technology and investments. Our Turbomachinery Control Solution also allows for self-sufficient support in a familiar system environment, so if you have an Experion system that your technicians and engineers are already trained on, you're going to save money. We incorporate a common hardware and software platform and allow for a common pool of maintenance spares. For example, if a customer has a C300 controller or a series C IO in stores, he doesn't have to replenish and buy new stocks, etc. He can utilize what he has. And finally, we ensure effective and consolidated data reporting and archiving.

FIGURE 5: Honeywell Turbomachinery Control: Safety Manager SC300

Built to safely Shutdown your Turbine and / or Compressor



- TÜV Certified SIL3 Out of the Box
- TÜV Certified Online Modifications
- ISASecure Certification
- Tight Experion PKS Integration
- Management Of Change (IEC61511)
- Supports Offline / Cloud Simulation
- Electronic Overspeed Protection (API-670 / IEC-61508) In Development
- Compress Surge Detection (API-670 / IEC-61508)
- Universal IO Design

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